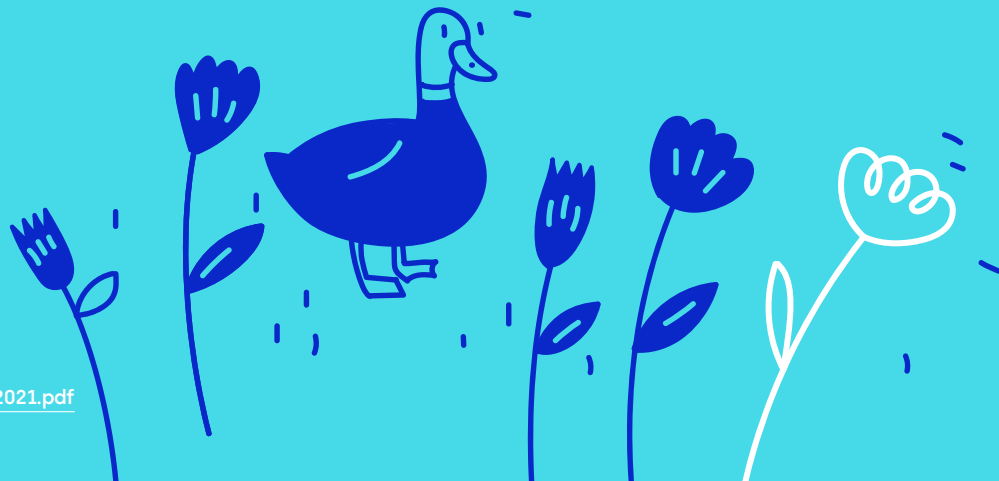
Climate Change Adaptation Report 2021

Appendix 1
Additional Risks

Affinity Water

Contents

Introduction



3 For more information go to www.affinitywater.co.uk/docs/reports/2022/Climate-Change-Adaptation-report-2021.pdf

Introduction

The Third National Climate Change Risk Assessment for the UK (CCRA3) and the Intergovernmental Panel on Climate Change Sixth Assessment report highlight that under all scenarios of emissions reduction we will increasingly feel the impacts of climate change and need to adapt to these.

As the UK's largest water supply only company we recognise the important role we play, not only in providing an essential service but, also as stewards of the environment. We have therefore undertaken a risk-based review of the challenges posed by climate change to our business, both now and in the future.

Drawing on the results of this risk assessment, in December 2021 we reported to Defra on six headline risks that we face from climate change, as well as on progress we have made since 2015 in adapting to them. We also set out our plans for action and investment to further adapt to these risks and improve the resilience of our operations to climate change.

The six headline risks we reported to Defra in our Adaptation Report 2021 are:

1. Increase in demand due to higher temperatures throughout the year, exacerbated during summer peak demand periods
2. Equipment and asset failure due to extreme weather events
3. Increase in competition for, and price of, raw water imports
4. Reduced availability of ground and surface water due to drought
5. Outage due to flooding of sites
6. Deterioration in raw water quality due to changes in rainfall and temperature, leading to loss of sources.

However, beyond the six headline risks, our detailed risk assessment identified nearly 30 risks from climate change to our business. This Addendum Report describes these risks in more detail, setting out the potential impact on our business and the actions we are taking and plan to take to adapt to them to mitigate their impact.

For each additional risk, we have shown the findings of our risk scoring exercise using a graduated bar graphic. We have scored each risk based on its likelihood of occurrence and the consequence if it does occur in 2050, using a 1-25 scale.

We have scored each risk three times:

- An inherent risk score in 2050 if we take no action.
- A score that takes account of actions already committed to in Asset Management Period 7 (AMP7) between 2020 and 2025.
- A target risks score for the risk in 2050.

The gap between the second and third risk scores highlights where we need to target additional action to further adapt to the risk.

We know that we need to embed the actions identified in the Adaptation Report and this Addendum Report across our business and make managing climate risk part of business as usual. We have, therefore, assigned ownership of each risk in this report to a Director within our business. Responsibility and accountability for delivering the adaptation actions described for each risk lies with that Directorate, or in some cases, a combination of Directorates. By taking action through AMP7 and beyond, the risks that we have identified become manageable.

We will incorporate the latest climate change scenarios into our next price review submission (PR24) and will look to make further improvements to our climate change resilience as more information becomes available.

Report structure

Each risk from our detailed risk assessment is presented on one slide in this report, following the same structure.

Climate variable(s) and resulting **hazard(s)** that leads to the risk

Risk name

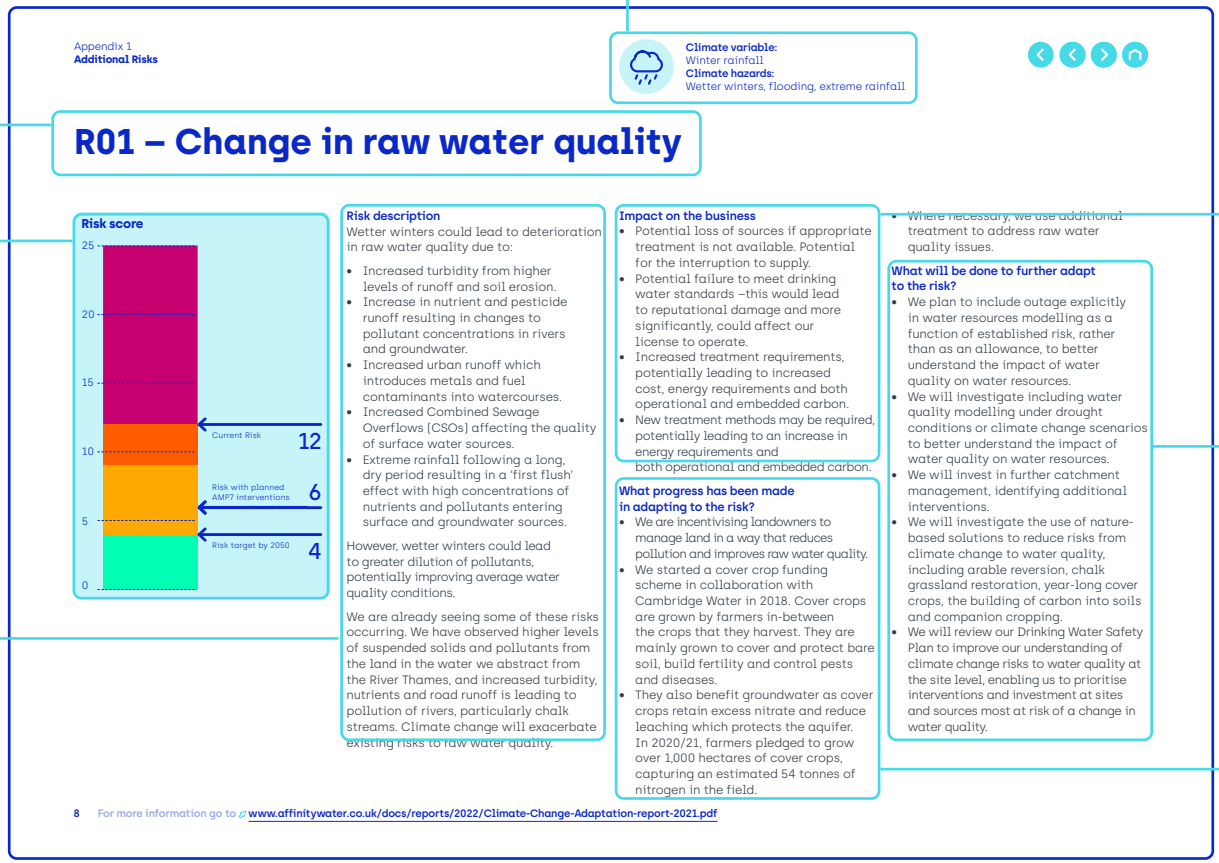
Graduated bar graphic showing the three risk scores current risk, risk with planned AMP 7 actions, target risk by 2050

Risk description setting out the risk posed to our operations from change in climate variables and the resulting climate hazards.

Impact on the business description of how the risk could affect our services and performance

Further adaptation action either planned in AMP7 or beyond

Adaptation progress describes action taken since 2015 to manage the risk

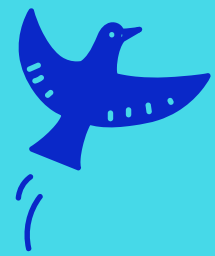


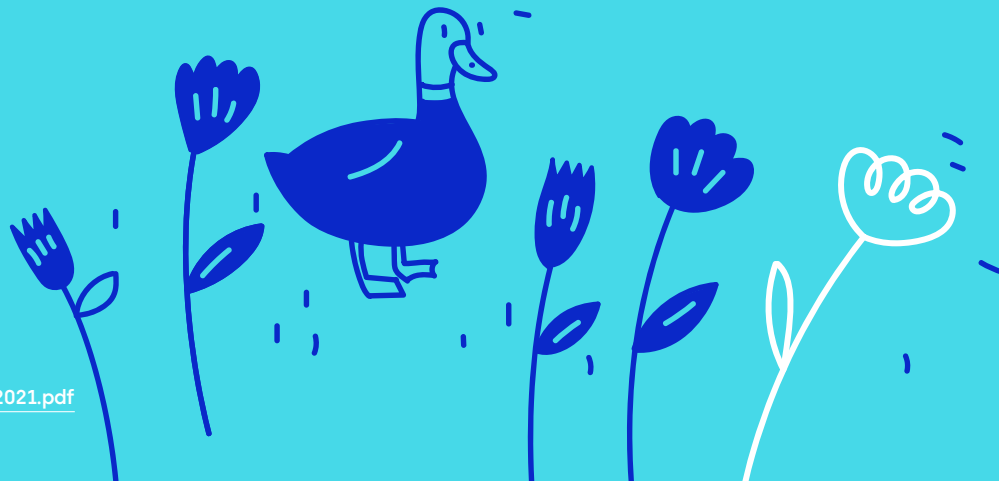
Relationship of our risks to the national climate change risk assessment

Our climate change risk assessment has been informed by key infrastructure risks set out in the UK's national climate change risk assessment (CCRA3) that are relevant to our business. We mapped the six headline risks in our Adaptation Report to the National CCRA risks and have done a similar mapping exercise for the additional risks presented in this Addendum Report. The relationship of the additional risks to the National CCRA risks are shown in the table.

National CCRA risks	Affinity Water Additional Risks
In1: Risks of cascading failures from interdependent infrastructure networks	R15, R18, R20, R23, R24, R25, R27
In2: Risks to infrastructure services from river, surface water and groundwater flooding	R02, R23, R24, R25, R26
In3: Risks to infrastructure services from coastal flooding and erosion	R06, R23, R24, R25, R26
In4: Risks of sewer and surface water flooding due to heavy rainfall	R01, R03
In5: Risks to bridges and pipelines from high river flows and bank erosion	R19, R21
In8: Risks to subterranean and surface infrastructure from	R21, R26
In9: Risks to public water supplies from drought and low river flows	R04, R05, R09, R10, R14, R17

Risks from climate change





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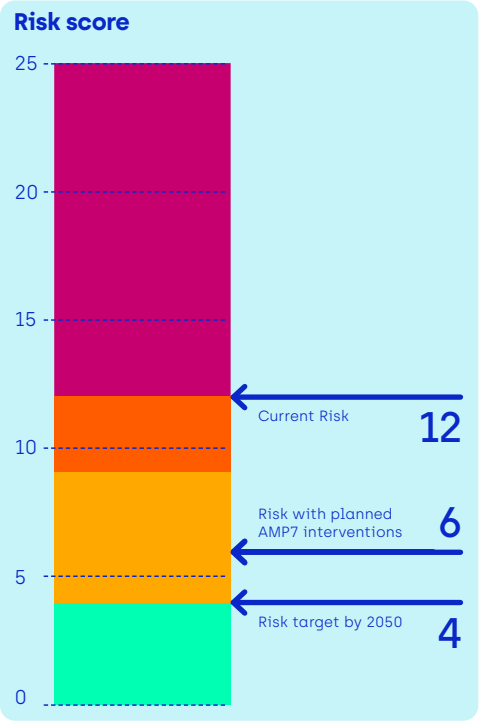
Climate variable:
Winter rainfall
Climate hazards:
Wetter winters, flooding, extreme rainfall

R01 – Change in raw water quality



Risk description

Wetter winters could lead to deterioration in raw water quality due to:

- Increased turbidity from higher levels of runoff and soil erosion.
- Increase in nutrient and pesticide runoff resulting in changes to pollutant concentrations in rivers and groundwater.
- Increased urban runoff which introduces metals and fuel contaminants into watercourses.
- Increased Combined Sewage Overflows (CSOs) affecting the quality of surface water sources.
- Extreme rainfall following a long, dry period resulting in a 'first flush' effect with high concentrations of nutrients and pollutants entering surface and groundwater sources.

However, wetter winters could lead to greater dilution of pollutants, potentially improving average water quality conditions.

We are already seeing some of these risks occurring. We have observed higher levels of suspended solids and pollutants from the land in the water we abstract from the River Thames, and increased turbidity, nutrients and road runoff is leading to pollution of rivers, particularly chalk streams. Climate change will exacerbate existing risks to raw water quality.

Impact on the business

- Potential loss of sources if appropriate treatment is not available. Potential for the interruption to supply.
- Potential failure to meet drinking water standards –this would lead to reputational damage and more significantly, could affect our license to operate.
- Increased treatment requirements, potentially leading to increased cost, energy requirements and both operational and embedded carbon.
- New treatment methods may be required, potentially leading to an increase in energy requirements and both operational and embedded carbon.

What progress has been made in adapting to the risk?

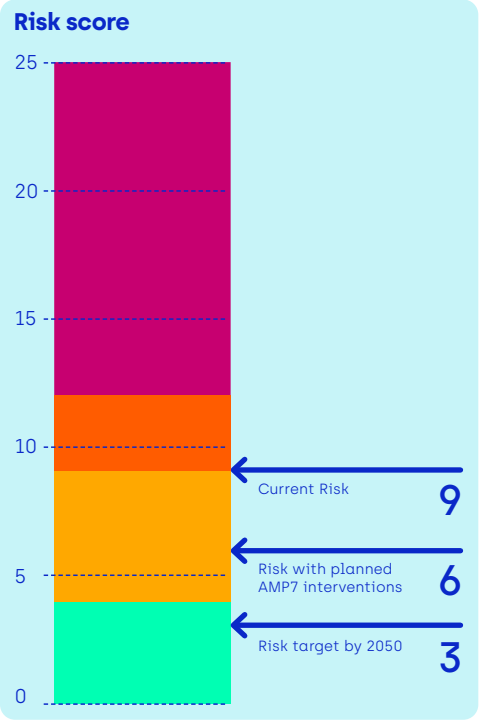
- We are incentivising landowners to manage land in a way that reduces pollution and improves raw water quality.
- We started a cover crop funding scheme in collaboration with Cambridge Water in 2018. Cover crops are grown by farmers in-between the crops that they harvest. They are mainly grown to cover and protect bare soil, build fertility and control pests and diseases.
- They also benefit groundwater as cover crops retain excess nitrate and reduce leaching which protects the aquifer. In 2020/21, farmers pledged to grow over 1,000 hectares of cover crops, capturing an estimated 54 tonnes of nitrogen in the field.
- Where necessary, we use additional treatment to address raw water quality issues.

What will be done to further adapt to the risk?

- We plan to include outage explicitly in water resources modelling as a function of established risk, rather than as an allowance, to better understand the impact of water quality on water resources.
- We will investigate including water quality modelling under drought conditions or climate change scenarios to better understand the impact of water quality on water resources.
- We will invest in further catchment management, identifying additional interventions.
- We will investigate the use of nature-based solutions to reduce risks from climate change to water quality, including arable reversion, chalk grassland restoration, year-long cover crops, the building of carbon into soils and companion cropping.
- We will review our Drinking Water Safety Plan to improve our understanding of climate change risks to water quality at the site level, enabling us to prioritise interventions and investment at sites and sources most at risk of a change in water quality.

Climate variable:
Winter rainfall
Climate hazards:
Wetter winters, flooding, extreme rainfall

R02 – Higher groundwater levels leading to boreholes going artesian



Risk description

65% of the water we supply comes from groundwater sources. Climate change is projected to lead to wetter winters and more intense rainfall events. These changes in rainfall patterns may increase groundwater levels, leading to boreholes going artesian (where water is forced to the surface without assistance) on a more frequent basis, potentially resulting in loss of groundwater sources.

When abstraction boreholes become artesian, it can result in water quality issues. If flood water enters below ground chambers under non-pumping conditions, it has the potential to re-enter boreholes when we resume pumping, leading to deterioration in water quality. There are also occasions where flooding can impact on the electric panels which could lead to site outages.

With boreholes becoming artesian more frequently as a result of wetter winters, there is also a risk of groundwater contaminants entering the surface water system. Nitrate levels may rise due to high groundwater level as nitrate-rich soils become saturated.

Impact on the business

- Potential loss of sources leading to increased outage and potential water resources deficit.
- Additional costs associated with capping our abstraction boreholes and ensure they are structurally stable.

What progress has been made in adapting to the risk?

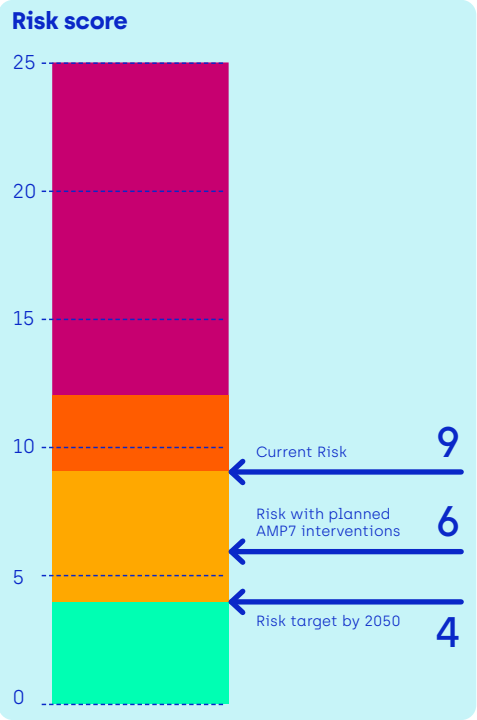
- We have mapped sites at risk of going artesian, based on experience during a flood event in 2014.
- We have undertaken a programme of installing sanitary seals on our abstraction boreholes, raising the headworks above the expected water level during flood conditions, and raising electric panels above flood level.
- We are adopting a different abstraction pattern to ensure no or minimal resting of sources at risk.

What will be done to further adapt to the risk?

- We will undertake a review of borehole structures to identify sources vulnerable to this risk.
- We will review the elevation of borehole headplates relative to anticipated flood levels to better understand the risk of specific boreholes going artesian.
- We will look to introduce additional redundancy into the system, enabling us to switch sources to maintain the supply to customers and build resilience.
- We are planning to assess the risk of groundwater emergence as part of our options appraisal process for new strategic resources and as part of our environmental programme.
- We are developing a framework for measuring resilience to customers and communities. Flooding and the extent to which it will affect our assets and our service is part of the framework approach. As a result, we will be able to identify which assets, at risk of flooding, will have the biggest impact on our communities and customers. Work to address the risks posed to these assets will be proposed for inclusion in our PR24 business plan.

Climate variable:
Summer rainfall, drought
Intense rainfall events
Climate hazards:
Extreme rainfall following dry period

R03 – First flush effect following dry periods leading to deterioration in raw water quality



Risk description

Climate change is projected to lead to more frequent and more severe droughts, punctuated by heavy rainfall events. Extreme rainfall after a period of long, dry weather results in a 'first flush' effect with high concentrations of nutrients and pollutants (such as metals and fuels from urban runoff) entering surface and groundwater sources.

This 'first flush' effect has an adverse impact on raw water quality. For example, after intense surface water runoff events, we have detected elevated concentrations of pollutants washing off the land in the water we abstract from the River Thames. We have also seen an increase in suspended solids and more turbidity. With an overall trend towards drier summers and rainfall increasingly falling in high-intensity events, climate change will exacerbate the risk of first flush events to raw water quality. This poses direct and indirect risks to chalk stream ecology.

Increased suspended solids from intense rainfall events can have an impact on the effectiveness of UV treatment and may mean that we need to use additional treatment measures.

Impact on the business

- Potential failure to meet drinking water standards – this would lead to reputational damage and more significantly, could affect our license to operate.
- Potential temporary or permanent loss of sources – reduced amount of water available.
- Increased treatment requirements, potentially leading to increased cost, energy requirements and both operational and embedded carbon.
- New treatment methods may be required, potentially leading to an increase in energy requirements and both operational and embedded carbon.

What progress has been made in adapting to the risk?

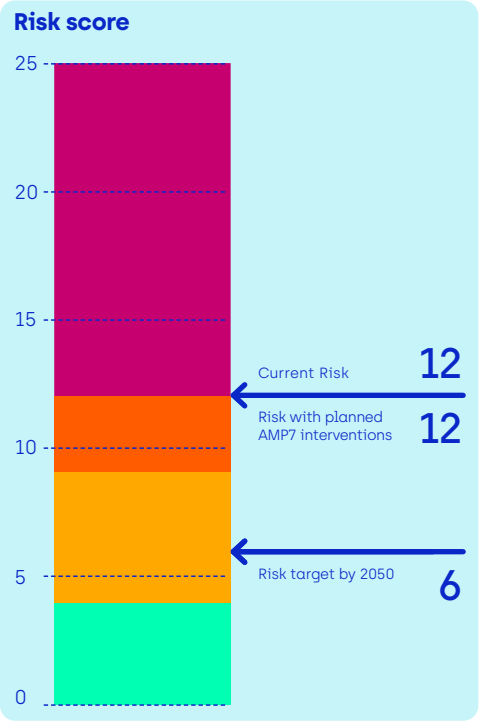
- We are incentivising landowners to manage land in a way that reduces the first flush effect.
- We use UV treatment and other techniques to treat raw water to drinking water standards but an increase in suspended solids in water can reduce the effectiveness of this treatment.
- We developed a Drought Resilience Action Plan incorporating lessons learnt from the 2016/2017 drought effects on water quality.
- We are undertaking a biosecurity audit, from which there will be recommendations for more signage and biosecurity infrastructure.
- We launched a mandatory e-learning module on INNS and biosecurity for all operational staff.

What will be done to further adapt to the risk?

- We plan to include outage explicitly in water resources modelling as a function of established risk, rather than as an allowance, to better understand the impact of water quality on water resources.
- We will review our Drinking Water Safety Plan (DWSP) to improve our understanding of climate change risks to water quality at the site level, enabling us to prioritise interventions and investment at sites and sources most at risk of first flush effect.
- We will investigate water quality modelling under drought conditions or climate change scenarios to better understand the impact of water quality on water resources.
- We will invest further in catchment management, identifying additional interventions and using nature-based solutions more precisely within catchments.

Climate variable:
Summer temperature
Climate hazards:
Warmer summers, longer growing season

R04 – Increase in invasive non-native species



Risk description

Current summer temperatures are too low to allow for the successful breeding of many non-native species that are already present (so-called 'sleeper species'), but an increase in air and water temperature due to climate change could lead to these species becoming invasive. We are also likely to see a continuation of the climate assisted spread of species native to Britain and Europe. At the moment, there is uncertainty about which new INNS may become a problem, for example, the Asian Hornet has only been found a few times in the UK to date but may become more problematic as the climate warms.

Transferring water between catchments and regions is an important part of regional water resource strategies. We are currently developing new strategic resource options that could involve importing raw water from other water companies. Raw water transfers represent a potential pathway for invasive non-native species (INNS) to spread. Restrictions on transfers to control INNS poses a risk to water resource availability and supply in our region.

INNS such as quagga and zebra mussels also pose a direct risk to our transfers and intakes, as they block pipes, making imports more difficult and incurring significant maintenance costs.

Impact on the business

- Restrictions on raw water transfers, making it more difficult to import water from outside of our region. This could reduce the amount of water available.
- Potential for an increase in the frequency of drought restrictions if we are unable to import water.
- Shift to more surface water imports over local groundwater sources may, if not properly managed, lead to greater risk of bio-fouling, biological degradation and biological growth in our surface waters, reducing the amount of water available.
- We will have a legal duty to prevent spread of INNS from our landholdings to others so the costs associated with monitoring, surveying and managing INNS across our land holdings are likely to increase.

What progress has been made in adapting to the risk?

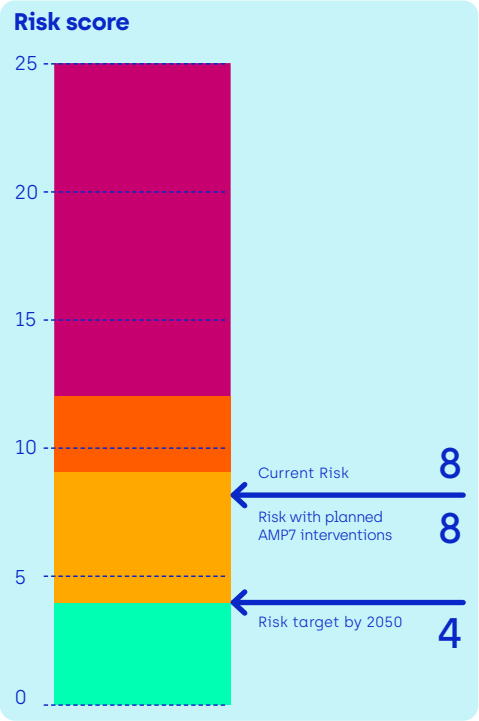
- We are carrying out INNS risk assessments for transfers and the six Strategic Resource Options (SROS).
- We are undertaking a biosecurity audit, from which there will be recommendations for more signage and biosecurity infrastructure.
- We have launched a mandatory e-learning module on INNS and biosecurity for all operational staff.
- We partnered on a literature review for the industry, the output of which is a database of known biosecurity options for a range of transfer types and species. These can feed into options appraisals for future raw water transfer options.

What will be done to further adapt to the risk?

We will consider additional or increased treatment of imports to deal with INNS.

Climate variable:
Seasonal average rainfall, temperature
Climate hazards: Hotter summers, longer growing season

R05 – Increase in pests and diseases



Risk description

Changes in seasonal temperature and rainfall patterns are likely to favour pests and diseases which thrive in a warm and humid environment.

An increase in pests and diseases will have a detrimental impact on agriculture, threatening both food and cover crops. Cover crops in particular are beneficial for groundwater as they help to retain excess nitrate and reduce leaching. With reduced cover crops due to increased pests and diseases, a greater amount of nitrate and other pollutants is likely to leach into aquifers, resulting in a deterioration of raw water quality and posing a risk to water resource availability in our region. Increased pest pressure on crops may lead to new herbicides being used which may pose water quality risks.

Pests and diseases will play a large role in the loss of critical ecosystem services. For example, Ash Dieback, a fungus which can thrive in certain seasons, is expected to kill 80% of ash trees across the UK. The loss of trees is significant because they provide shade, moderate temperature, promote soil stability, reduce runoff, favour infiltration and lock-in carbon.

We have an industry-wide tree planting commitment to have a net increase of 110,000 trees by 2030 against our 2018 baseline and lock in carbon. This means we need to be aware of how many trees are lost and look to replace them.

Impact on the business

- Potential failure to meet drinking water standards – this would lead to reputational damage and more significantly, could affect our license to operate.
- We are undertaking a biosecurity audit, from which there will be recommendations for more signage and biosecurity infrastructure.
- Potential loss of sources leading to increased outage.
- Costs associated with pest and disease control.
- Increased treatment requirements, potentially leading to increased cost, energy requirements and both operational and embedded carbon.
- New treatment methods may be required, potentially leading to an increase in energy requirements and both operational and embedded carbon.

What progress has been made in adapting to the risk?

- We are undertaking a biosecurity audit, from which there will be recommendations for more signage and biosecurity infrastructure.
- We have procedures in place for sampling and managing our own equipment. Our biodiversity framework contractor has robust biosecurity procedures in place.
- We launched a mandatory e-learning module on INNS and biosecurity for all operational staff.
- We are incentivising landowners to manage land in a way that reduces pollution and improves raw water quality including cover crops, minimum till, companion cropping and water friendly break crops which over time can reduce pests and diseases and the need for crop protection products.
- We hold information on the health of our trees captured by our trained tree health surveyors while on site in the EzyTreev database.
- We use strategic imports from outside Affinity Water region to ensure we have enough water to supply our customers.

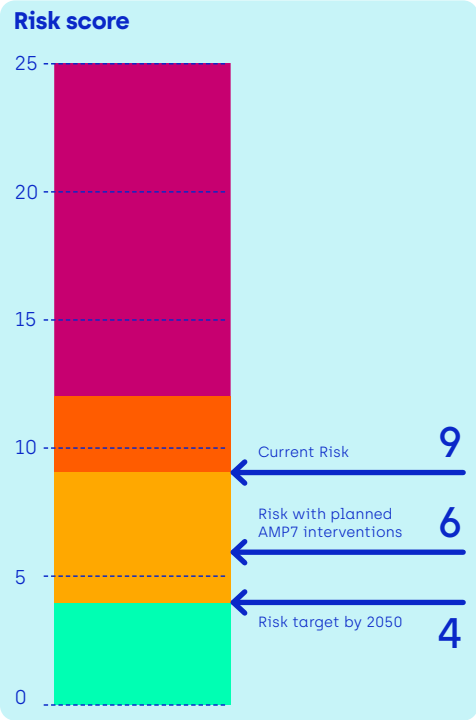
What will be done to further adapt to the risk?

We are producing an AWL Tree Strategy that will give guidance around how trees are to be inspected and how to identify high-risk trees. We will work with our arboriculture contractor to build climate change impacts into this process.

We will invest further in catchment management, identifying additional interventions and using nature-based solutions more precisely within catchments.

Climate variable: Sea level rise, storm frequency and intensity, sea spray
Climate hazards: Saline intrusion

R06 – Deterioration in raw water quality at coastal sites due to saline intrusion



Risk description

Sea level rise and more intense storms could lead to salt water entering groundwater sources at the coast. Sea level rise and increases in storm frequency and intensity, combined with storm surges could also increase the frequency and rate of coastal flooding and erosion. Changes to the coastline as a result of climate change and changing sea level, for example, natural changes to the deposition of gravel, can also lead to saline intrusion.

If significant saline intrusion into groundwater sources occurs, further treatment will be required to meet drinking water standards. There is potential for coastal sources to experience medium to long-term outage as a result of saline intrusion. Ultimately, it can be difficult to resolve saline intrusion and the source may be lost.

Some of our coastal sources in the south east are at risk from saline intrusion. In some places, coastal defences are in place which provides resilience to the risk of saline intrusion, however, it is uncertain how these defences will be maintained in future. If the current standard of defence is not maintained, there is a risk of saline intrusion into aquifers.

Some coastal sites are also important for ecology and the Environment Agency and Natural England have an obligation to ensure they are not affected by increased salinity. It could mean that land is managed to protect ecological sites, including purposefully flooding some areas, which may put our sources at greater risk.

Impact on the business

- Potential failure to meet drinking water standards – this would lead to reputational damage and more significantly, could affect our license to operate.
- Potential permanent loss of coastal sources – reduced amount of water available.
- Loss of water sources will need to be replaced with water from alternative sources. There is potential for hard water to be replaced with soft water which our customers may not be happy with.
- Increased treatment requirements, potentially leading to increased cost, energy requirements and both operational and embedded carbon.
- New treatment methods may be required, potentially leading to an increase in energy requirements and both operational and embedded carbon.

What progress has been made in adapting to the risk?

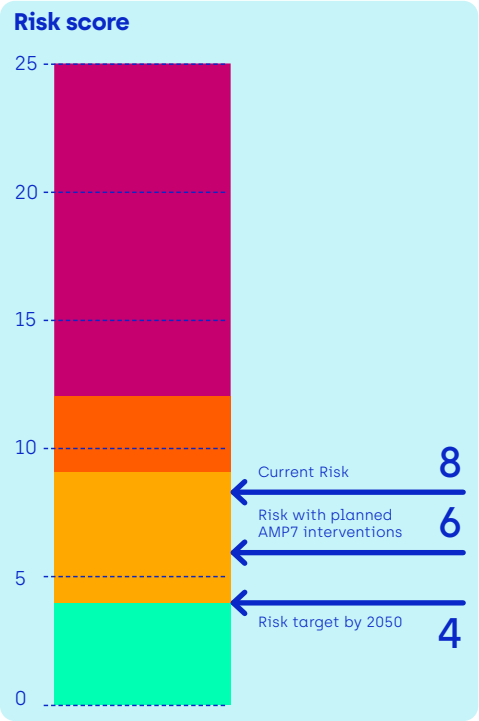
- Where necessary, we can blend water from multiple treatment streams to meet drinking water standards and mitigate the risk of saline intrusion.
- Groundwater salinity monitoring is in place in strategically located abstraction wells that acts as an 'alarm' when salinity gets to a certain level.
- At some of our coastal sources, we have a programme of monitoring which identifies salinity changes in the surface water bodies.

What will be done to further adapt to the risk?

- We will consider future flood defence requirements at coastal sites where necessary.
- We will look at alternative treatment approaches for sources affected by saline intrusion, including reverse osmosis.
- We will consider undertaking additional monitoring to help identify saline intrusion triggers, groundwater salinity changes and recovery time following storm events.

Climate variable:
Summer temperatures
Climate hazards:
Warmer summers

R09 & R10 – Increase in frequency and severity of algal blooms



Risk description

Climate change is projected to increase temperatures resulting in hotter summers. This will lead to an increase in the frequency and severity of algal blooms in our surface waters.

Algal blooms have a negative impact on water quality by releasing toxins creating taste and odour problems in drinking water. Consequently, treatment of algae-laden waters often require additional processes and the implementation of source water protection zones to reduce nutrient loads.

Algal blooms also pose a health and safety risk at recreational sites as toxin-contaminated water can cause illness when swallowed.

Impact on the business

- Potential loss of sources due to contamination leading to increased outage and supply interruption.
- Potential failure to meet drinking water standards – this would lead to reputational damage and more significantly, could affect our license to operate.
- Restrictions on transfers, making it more difficult to import water from outside of our region. This could reduce the amount of water available.
- Reduced availability of sites for third party use such as for recreational purposes.
- Increased treatment requirements, potentially leading to increased cost, energy requirements and both operational and embedded carbon.
- New treatment methods may be required, potentially leading to an increase in energy requirements and both operational and embedded carbon.

What progress has been made in adapting to the risk?

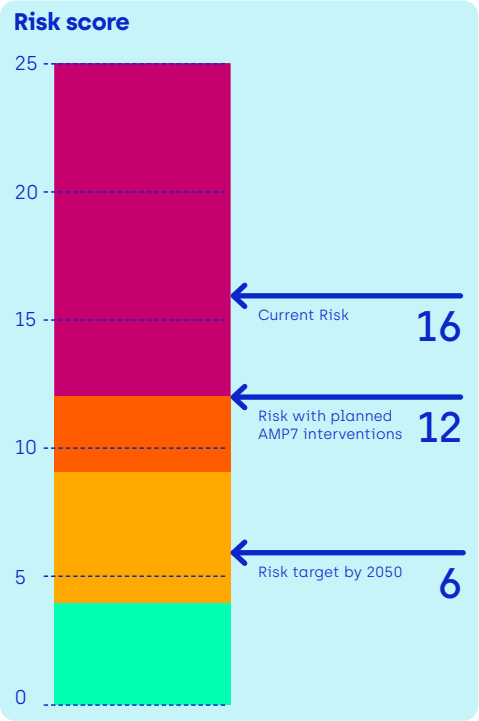
- We use UV treatment and other techniques to treat raw water to drinking water standards.
- Where necessary, we use additional treatment to address raw water quality issues.
- We partnered on a literature review for the industry, the output of which is a database of known biosecurity options for a range of transfer types and species. These can feed into options appraisals for future raw water transfer options.

What will be done to further adapt to the risk?

- We will invest in further catchment management, identifying additional interventions and using nature-based solutions more precisely within catchments.

Climate variable:
Summer rainfall, winter rainfall, drought
Climate hazards:
Warmer summers

R14 – Potential loss of chalk groundwater sources due to drought



Risk description

The UK has 85% of the world's chalk streams with 283 found in England. Our supply area is home to many of these rare chalk streams and we abstract water from chalk aquifers (within licence) for water supply. Water from chalk aquifers is generally of good quality and provides a local source of water to customers. Chalk streams are also considered to be of high cultural and ecological value and provide recreational opportunities.

Chalk aquifers are reliant on groundwater recharge which typically occurs in the winter period.

Climate change has the potential to impact on aquifer recharge in terms of the amount of effective rainfall and shortening of the recharge period. In addition to this, more extreme events like drier summers can influence the chalk stream baseflow in cases where secondary aquifers also contribute to baseflow.

The impact of drought and changing rainfall patterns throughout the year, coupled with an increase in peak demand during hot, dry spells is likely to put additional pressure on water supplies in our region.

Impact on the business

- Loss of supply from interruption from drought vulnerable sources from more extreme droughts or prolonged peak demand events.

What progress has been made in adapting to the risk?

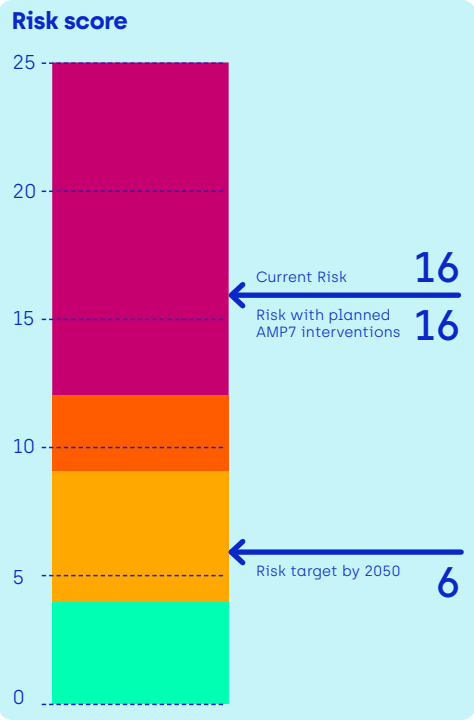
- Through our Sustainability Reduction programme, we have reduced chalk groundwater abstraction since the 1990s by 73Ml/d.
- We are working with the Environment Agency and other catchment partners to deliver an industry leading Revitalising Chalk Rivers programme for river restoration and habitat enhancement.
- We are working with the Catchment Based Approach Chalk Restoration Steering Group to develop chalk stream catchment restoration projects for inclusion in PR24.
- We are developing six strategic resource options (SROs) between 2020-2025 to secure long-term water resources for our region and deliver environmental improvements.
- We have invested significantly in catchment management to improve water quality and water resources with added biodiversity and wider natural capital benefits.
- Our Drought Plan prioritises actions with less impact on the environment including new environmental stress triggers and environmental monitoring.
- We are restoring sustainable abstraction through reducing abstraction from sensitive sources during low flows (through our Abstraction Incentive Mechanism).
- Our Supply 2040 scheme will transfer water from areas of our Central region where we have a surplus to areas where the water is needed.
- We have invested in water treatment upgrades to address changes in water quality arising from drought

What will be done to further adapt to the risk?

- Through our WRMP planning process, we are taking steps to be resilient to up to a 1 in 200 year return period drought event without the need for drought permits beyond 2024. We have the ambition through the National Framework for Water Resources to increase this to 1 in 500 year return period drought events by 2040.
- Increase capture of surface water and increase storage capacity.
- Continue to review our abstraction in light of sustainability reductions and the Environment Agency's abstraction licensing strategy.
- Additional investment in catchment management for water resources and water quality.
- There is further potential to use natural flood management options which will have wider benefits in terms of asset protection, water resources and quality, biodiversity and natural capital.

Climate variable:
Summer temperature
Climate hazards:
Hotter summers, heatwaves

R15 – Temperatures exceeding critical temperature threshold for above ground infrastructure leading to outage



Risk description

Climate change is projected to lead to higher average temperatures and more heatwaves.

The treatment and movement of water around our network relies on a range of assets which are sensitive to high temperatures. For example, pumps operate most efficiently within a defined temperature range and if this is exceeded during a heatwave, the efficiency of the pump may decrease or the pump may fail. High temperatures can also lead to failure of ICT and communications equipment if they are not sufficiently cooled.

Failure of equipment can lead to temporary shutdowns of sites, putting pressure on other sources and potentially leading to outage. This risk is exacerbated by the increases in peak demand that we experience during periods of hot weather, as sources are relied upon to run at maximum capacity.

Many of our assets are interdependent with other infrastructure systems, such as energy and communications, which themselves are exposed to risks from climate change.

Impact on the business

- Increased outages and potential interruption to supply leading to reputational damage and penalties from regulators. Increased maintenance and accelerated replacement costs.
- Pumps operating inefficiently, leading to increased operating costs.

What progress has been made in adapting to the risk?

- We have installed backup power (diesel generators) at our critical sites.
- Investing in a solar power programme to self-generate. Reducing our dependency on electricity from the grid through self-generation builds resilience to the risk of power outages associated with extreme weather events.
- Our Emergency and Crisis Management Plans describe the structure, and define the roles and responsibilities, that form the basis of our emergency response to events such as freeze-thaw events. Our plans have been written to align with emergency response best practice (Joint Emergency Services Interoperability Principles (JESIP)).

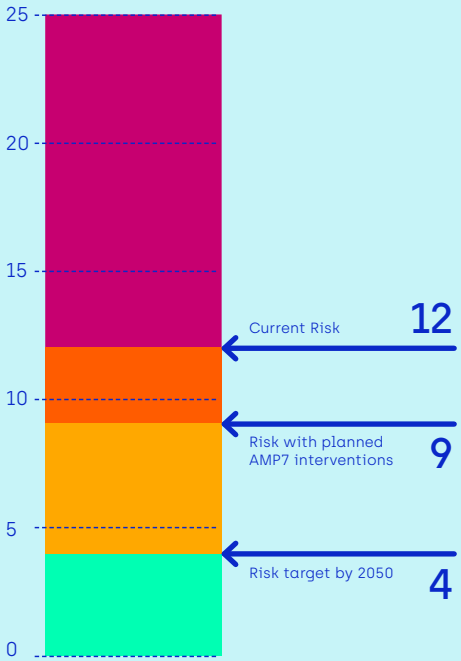
What will be done to further adapt to the risk?

- We plan to undertake risk assessments at our critical sites to identify assets at risk from extreme temperatures and prioritise where we need to invest in additional cooling measures, e.g. improving insulation and green roofs.
- We will investigate the use of nature-based solutions to increase shade and reduce the temperature at priority sites.
- We are developing a framework for measuring resilience to customers and communities. High temperatures and the extent to which they will affect our assets and our service is part of the framework approach. As a result, we will be able to identify which assets, at risk from high temperatures, will have the biggest impact on our communities and customers. Work to address the risks posed to these assets will be proposed for inclusion in our PR24 business plan.

Climate variable:
Summer temperatures, drought
Climate hazards:
Warmer summers

R17 – Rising water demand leading to increased volume of bursts

Risk score



Risk description

Warmer summers and increased frequency and severity of heatwaves will lead to greater peak demand and prolonged peak demands for water during summer months.

Higher and more prolonged peak demand can place additional stress on assets, leading to more rapid deterioration in asset condition and increasing the risk of failure.

Changes in soil moisture, with repeated wetting and drying cycles may also lead to damage to underground pipes and an increase in leakage. Drier conditions can cause the ground to dry out and crack and wetter conditions can lead to heave, particularly in areas with clay soils.

Impact on the business

- Increased maintenance requirements and accelerated replacement costs.
- Increased leakage and threat to achieving leakage targets. Reputational damage.
- Interruption of supply to customers.

What progress has been made in adapting to the risk?

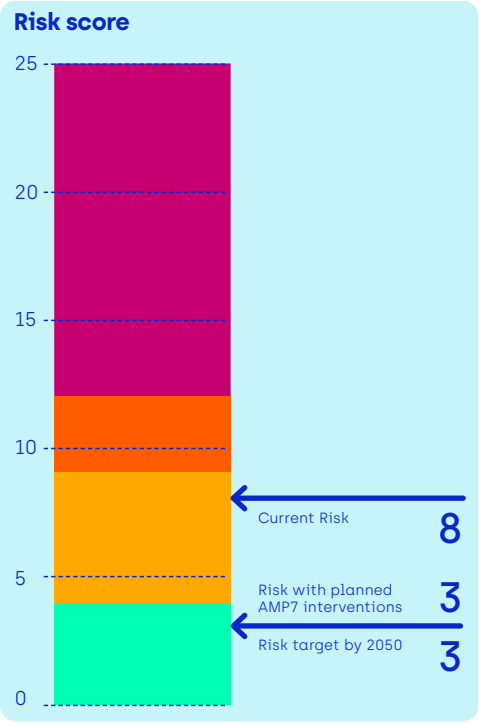
- We have a proactive approach to replacing our underground assets based on age, condition, and burst history. We replaced 13.6km of pipes in year 1 of AMP7, in line with our business plan.
- We also undertake reactive repairs of bursts when they occur.
- We currently have a target to reduce leakage by 20% within the period 2020 - 2025 period through increasing the intensity of leakage activities, innovation, efficiency and reducing customer side leakage. This is higher than the target of 18.5% set by our Water Resources Management Plan in 2019
- Our 2020 – 2025 Demand Management programme is targeting a 12.5% reduction in per capita consumption (PCC). The programme includes 21 demand management projects, including: behaviour change, education and engagement, in-home water efficiency, automation, non-per-capita consumption measures and campaigning.
- Extensive analytics are currently being undertaken to understand the root cause of bursts to enable targeted mitigation plan.

What will be done to further adapt to the risk?

- Beyond 2025, we propose to continue to further reduce PCC through concerted action on water efficiency and smart metering.
- We share the water industry wide ambition to reduce leakage by 50% before 2050.
- Digital Twin – we are trialling a burst modelling tool to identify where there are risks of failure in pipes across the business to better allocate resources.
- We are increasing the rate at which we replace our water network pipes.
- We are looking at smart networks to create a 'calmer' network.

Climate variable:
Summer temperatures, drought
Climate hazards:
Extreme rainfall, warmer summers

R18 – Risks to staff health and safety



Risk description

Warmer summers and increased frequency and severity of heatwaves may impact the health and safety of our staff. For example, outdoor workers are more likely to experience heat stress, heat stroke and sun burn. Indoor office workers may experience a drop in productivity resulting from increased room temperature and reduced thermal comfort of buildings.

There may also be a general increase in staff sickness, causing disruption to operational services. A shortage of staff or reduced working hours may lead to disruption in water supply and longer maintenance or repair times for malfunctioning equipment.

Warmer weather may increase numbers of insect species, such as mosquitoes, potentially leading to increased risk of exposure to diseases which put staff at risk from illness.

Other climate events such as an increase in flooding and storms will also pose a health and safety risk to on-site staff and reduce safe access for critical sites. These events may cause injury resulting in a shortage of site-critical staff.

Impact on the business

- Increased rate of supply interruption and / or lead to increased outages.
- Reputational damage.
- Interruptions to supply chain operations.
- Increase in staff sickness and absence, potentially impacting on operations and customer service.

What progress has been made in adapting to the risk?

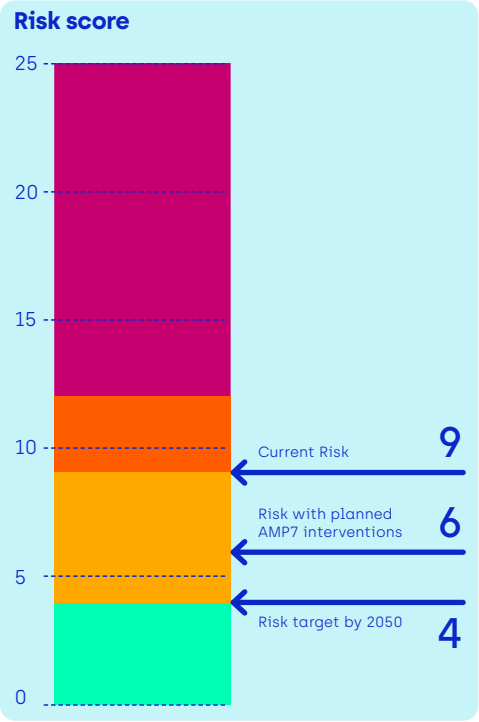
- Provide appropriate warm weather personal protective equipment (PPE) provisions.
- Increased level of working from home for staff to reduce commuting.

What will be done to further adapt to the risk?

- We will revise risk assessments to take account of risks to staff associated with extreme weather.
- We will look to change the timing of outdoor working, avoiding the hottest periods.
- We will look to provide additional (PPE) to outdoor working staff, including sun hats and sun cream.
- Provide additional staff welfare facilities including provision of shade.
- Provide awareness of risks and training on undertaking dynamic risk assessments for staff.

Climate variable:
Extreme temperatures, snow and ice, frost days
Climate hazards:
Wetter winters

R19 – Freeze thaw events leading to pipe cracking and leakage



Risk description

Periods of cold weather (sub-zero temperatures) followed by a rapid thaw can result in pipe cracking, leading to bursts and leakage. Whilst average winter temperatures are expected to increase as a result of climate change, periods of low temperatures could be more severe when they occur. Pipe bursts can disrupt water supply to customers and put pressure on water resources, as well as causing leakage.

The 'Beast from the East' event in 2018 and the subsequent thaw led to an increase in both mains bursts within our network and customer side bursts. However, the actions we took in response to this freeze-thaw event, including using a leakage monitoring system and deployment of additional detection and repair teams, meant that our response time to bursts was short and underlying leakage was minimised.

Pipe bursts and leakage can disrupt water supply to customers and put pressure on existing water resources.

Impact on the business

- Failure to address leakages and pipe bursts will result in economic penalties and cause reputational damage.
- Potential for supply interruption.
- Increased maintenance and accelerated replacement costs.
- Increased pumping will lead to additional costs.
- Increased leakage management costs.

What progress has been made in adapting to the risk?

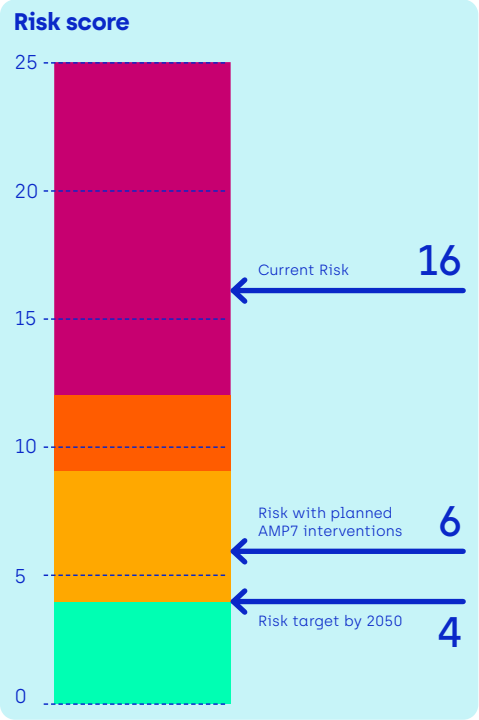
- We have a proactive approach to replacing our underground assets based on age, condition, and burst history. We replaced 13.6km of pipes in 2020, in line with our business plan.
- We carry out reactive repair of bursts.
- We communicate with customers on the need to protect pipes from cold weather.
- Our Emergency and Crisis Management Plans describe the structure, and define the roles and responsibilities, that form the basis of our emergency response to events such as freeze-thaw events. Our emergency plans have been written to align with emergency response best practice (Joint Emergency Services Interoperability Principles (JESIP)).
- We currently have a target to reduce leakage by 20% within the period 2020 - 2025 period through increasing the intensity of leakage activities, innovation, efficiency and reducing customer side leakage. This is higher than the target of 18.5% set by our Water Resources Management Plan in 2019.

What will be done to further adapt to the risk?

- We are investing more in pipe renewals and increasing the rate at which we replace our water network pipes.
- We share the water industry wide ambition to reduce leakage by 50% before 2050 through increasing the intensity of leakage activities, innovation, efficiency and reducing customer side leakage.

Climate variable:
Rainfall, storms
Climate hazards:
Extreme rainfall, storm events, high winds

R20 – Increased risk of fallen trees and large debris in watercourses



Risk description

Climate change is projected to change weather patterns which include extreme rainfall and storm events. These events have the potential to increase the risk of fallen trees and large debris in watercourses which could reduce river flow and increase flood risk.

Fallen trees at critical sites will also pose a health and safety risk, may impede access for site staff and damage our assets.

We face risks from our own tree stock but also those which are the responsibility of third parties. These risks can be more difficult to manage. There are also risks from third-party trees which are more difficult to manage.

Impact on the business

- Potential failure to meet drinking water standards – this would lead to reputational damage and more significantly, could affect our license to operate.
- Increased treatment requirements, potentially leading to increased cost, energy requirements and both operational and embedded carbon.
- New treatment methods may be required, potentially leading to an increase in energy requirements and both operational and embedded carbon.
- Potential temporary loss of sources leading to supply interruption.
- Costs associated with debris removal operations.

What progress has been made in adapting to the risk?

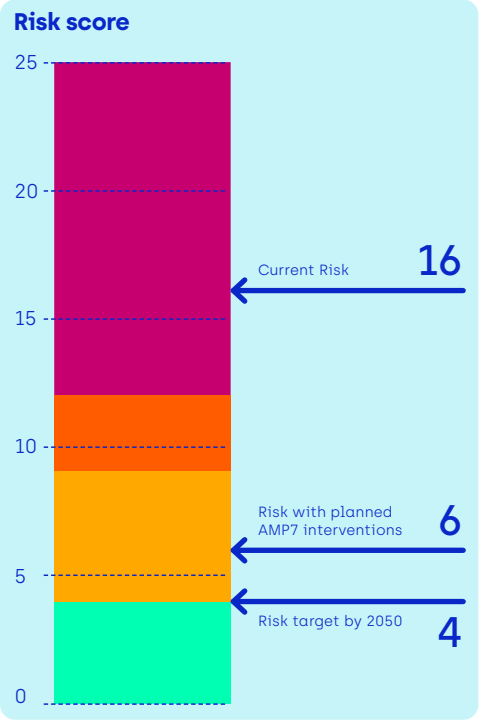
- Risks from our own trees are managed through our tree safety inspection process. We hold information on the health of our trees, which is captured by our trained tree health surveyors while on-site, in the EzyTreev database. Trees are currently inspected on an 18 month cycle and recommendations for work are programmed in to Ezytreev based on risk.
- We have invested in flood defences at critical sites assessed as being most at risk of flooding, including flood gates and demountable barriers.

What will be done to further adapt to the risk?

- We are producing an AWL Tree Strategy that will give guidance around how trees are to be inspected and how to identify high risk trees. We will work with our arboriculture contractor to build climate change impacts into this process.
- We will invest further in catchment management, identifying additional interventions and using nature-based solutions more precisely within catchments.

Climate variable:
Summer temperatures, drought
Climate hazards:
Drier summers

R21 – Changes in soil moisture content leading to increased volume of bursts and leaks



Risk description

Soil swelling during wet periods can cause heave, or lifting of structures, whilst soil shrinkage during dry periods can cause settlement or subsidence. With climate change bringing warmer and drier summers and wetter winters, soil shrink-swell is likely to occur more frequently and movement of soil may occur more quickly. Wetter winters may lead to soils becoming saturated and this water can freeze when temperatures are low. These changes in soil moisture could cause buried pipes to move and break, leading to an increase in the volume of bursts and leaks we experience.

Impact on the business

- Increased supply interruption.
- Reputational damage.
- This will be a contributory factor in failure to meet leakage targets.
- Increased maintenance and accelerated replacement costs.

What progress has been made in adapting to the risk?

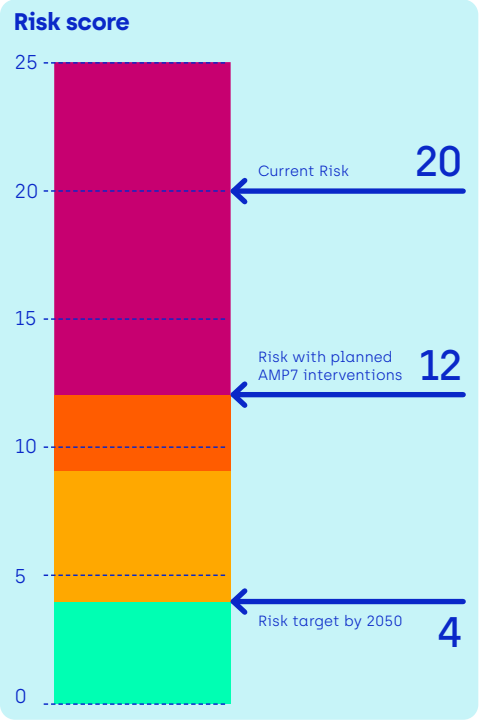
- We have a proactive approach to replacing our underground assets based on age, condition, and burst history. We replaced 13.6km of pipes in 2020, in line with our business plan.
- We carry out reactive repair of bursts.
- Our Water Resources Management Plan provides for 18.5% leakage reduction within the 2020 to 2025 period through increasing the intensity of leakage activities, innovation, efficiency and reducing customer side leakage.
- Our plans have been written to align with emergency response best practice (Joint Emergency Services Interoperability Principles (JESIP)).

What will be done to further adapt to the risk?

- We are investing more in pipe renewals and increasing the rate at which we replace our water network pipes.
- We share the water industry wide ambition to reduce leakage by 50% before 2050 through increasing the intensity of leakage activities, innovation, efficiency and reducing customer side leakage.
- We are considering using pipe materials which are more flexible and able to withstand soil movement.

Climate variable:
Winter rainfall, extreme rainfall
Climate hazards:
Extreme rainfall events, flooding

R23, R24 & R25 – Power outages at our sites due to extreme weather events



Risk description

Our sites are powered by electricity from the national grid.

Climate change is projected to lead to more frequent and more intense extreme weather events, such as floods, storms, and heatwaves. These events have the potential to damage electricity distribution networks, including overhead lines, which are critical to supplying power to our sites.

Power outages would lead to disruption of services, potentially leading to the temporary shutdown of sites and outages. Outages can also affect our mobile phone network which could take our telemetry equipment offline. Extreme events such as flooding may restrict access for staff to make repairs and restore power.

Power outages at our offices and customer contact centre also presents a risk in terms of our operations and customer service.

Impacts on the business

- Increased outages.
- Reputational damage.
- Office staff unable to work.
- Customers unable to contact us – reduced customer service.

What progress has been made in adapting to the risk?

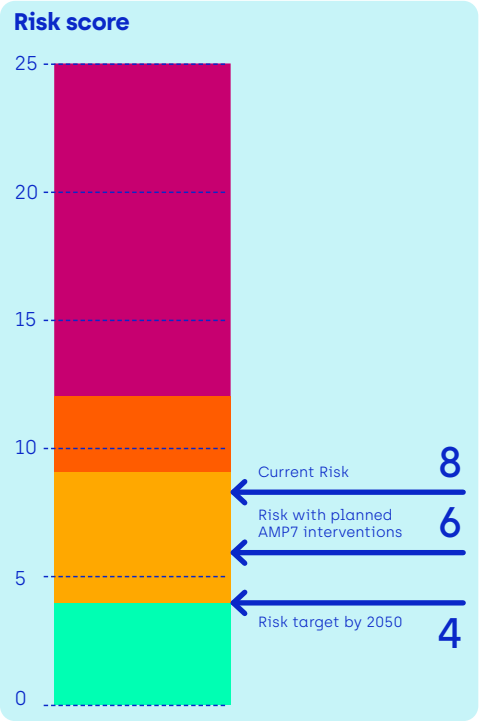
- We have completed an exercise to map sites at risk from power outages.
- We have installed backup power (diesel generators) at our critical sites.
- Mutual aid agreements with water companies.
- Investing in a solar power programme to self-generate. Reducing our dependency on electricity from the grid through self-generation builds resilience on the risk of power outages associated with extreme weather events.
- We are looking at implementing smart networks to create a 'calmer' network
- We are leading the industry wide review of National Power Outage response and recovery plans with DEFRA as part of a multi-sector project.
- We are well positioned for our office staff to work from home in the event of local power outages.

What will be done to further adapt to the risk?

- Undertake a risk assessment to identify assets at risk from extreme weather and use the results to prioritise further investment.
- We are developing a framework for measuring resilience to customers and communities. Flooding and the extent to which it will affect our assets and our service is part of the framework approach. As a result, we will be able to identify which assets, at risk of flooding, will have the biggest impact on our communities and customers. Work to address the risks posed to these assets will be proposed for inclusion in our PR24 business plan.
- We are reviewing power resilience options including batteries and hydrogen engines.

Climate variable:
Winter rainfall, extreme rainfall
Climate hazards:
Extreme rainfall events, flooding

R26 – Water ingress into pumping assets or boreholes due to unsealed ducts



Risk description

Changing rainfall patterns and more extreme rainfall events and sea level rise will exacerbate the risk of flooding across our region. During flood events, there is potential for flood water ingress into pumping assets or boreholes through unsealed ducts. Flood water ingress poses a risk to water quality, as well as damage to pipes.

Impact on the business

- Potential failure to meet drinking water standards – this would lead to reputational damage and more significantly, could affect our license to operate.
- Increased treatment requirements, potentially leading to increased cost, energy requirements and both operational and embedded carbon.
- Increased maintenance and accelerated replacement costs.

What progress has been made in adapting to the risk?

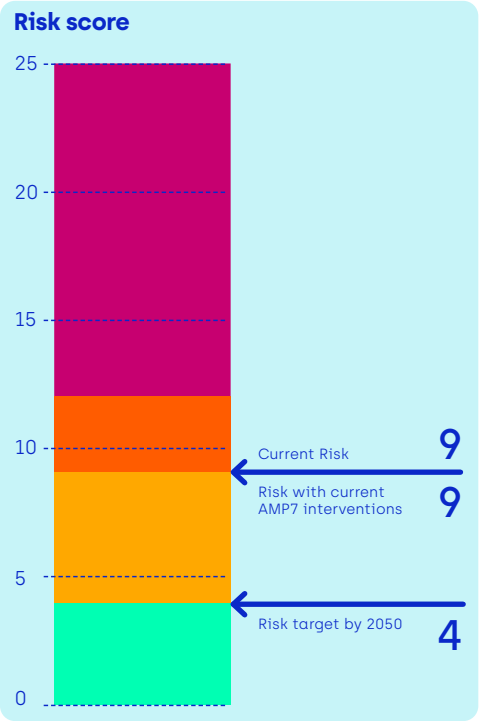
- We invested in temporary flood defences, including flood gates and demountable barriers which can be deployed to reduce the risk of flood water ingress and damage to assets.
- We installed sump pumps to drain surface water ingress at critical sites.

What will be done to further adapt to the risk?

- Update region-wide FRA to include the latest climate change projection data and Environment Agency allowances for climate change. It will also include a review of investment in flood defences at critical sites.
- Identify priority sites and assets for investment.

Climate variable:
Summer rainfall, drought
Climate hazards:
Extreme rainfall, warmer summers

R27 – Increase in use of GSHPs leading to deterioration in water quality



Risk description

Ground Source Heat Pumps (GSHP) pose a risk where the GSHP is deep enough underground and close to or located within chalk aquifers. As we move to a Net Zero economy, the popularity of GSHPs is likely to increase. This could result in more GSHP boreholes being drilled, creating pollutant pathways to aquifers and increasing groundwater temperature if not appropriately managed. This poses a risk to the quality of raw water we abstract. GSHPs are considered an emerging technology and the extent of risks posed by GHSPs to water sources are still uncertain.

GHSPs may contribute to increasing the temperature of groundwater which can accelerate the degradation of organic pollutants, leading to a reduction in groundwater quality.

There are potential opportunities for us to utilise GSHP technology at some of our sites.

Impact on the business

- Potential loss of sources due to contamination.
- Increased treatment requirements, potentially leading to increased cost, energy requirements and both operational and embedded carbon.
- New treatment methods may be required, potentially leading to an increase in energy requirements and both operational and embedded carbon.

What progress has been made in adapting to the risk?

- As an emerging technology, application of GSHPs are currently being considered by Affinity Water.
- We have responded to the Environment Agency's review of Environmental Permitting (Discharges) regulations on the topic of GSHPs.

What will be done to further adapt to the risk?

- Lobby for water companies to be statutory consultees on planning applications involving large scale GSHP technology.
- As GSHPs are a new technology, we will explore new developments, regulatory mechanisms and permitting requirements.
- Consider opportunity for GSHPs at our sites.
- Consideration of how to safeguard source protection zones during any GSHP construction.

Affinity Water